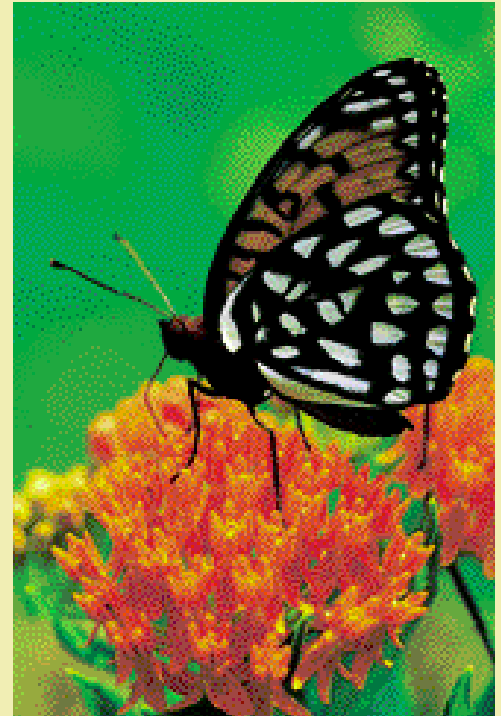
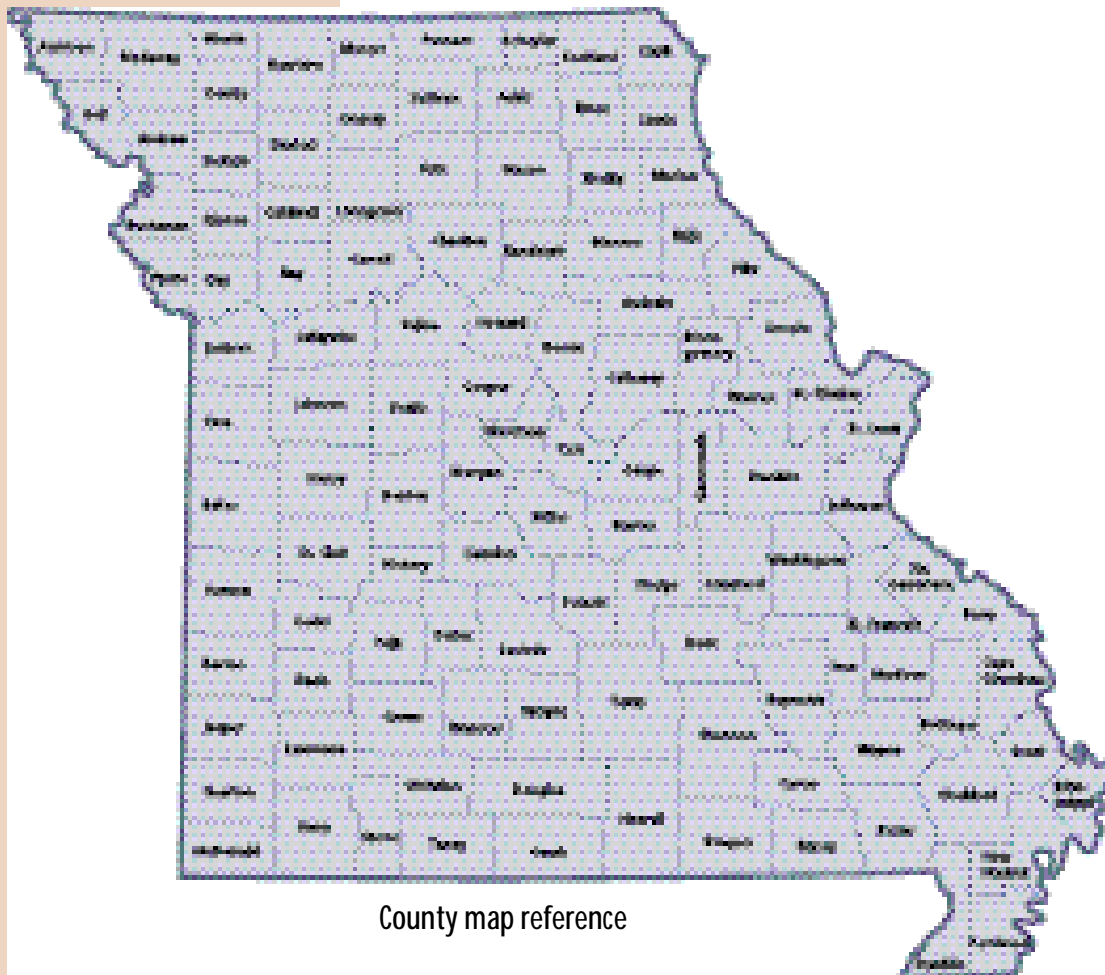


# Missouri **Animals** of Conservation Concern



Missouri Department of Conservation

# Missouri Animals of Conservation Concern



County map reference

**Front cover:** Regal fritillary and Niangua darter

**Back cover:** Least tern and Hine's emerald dragonfly

Cover photos by Jim Rathert except dragonfly, by Illinois State Museum

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# Introduction

Mark Sullivan

Missouri's wild places are homes for an extraordinary variety of creatures, largely unseen and unfamiliar to most of us. We are a state devoted to the beauty and recreational values of our great outdoors, yet few of us know that Missouri's diverse aquatic and terrestrial wildlife is remarkable on a global level. This exceptional biodiversity is a source of great pride—but also a source of grave concern.

Before European settlement, Missouri's landscape was a complex and varied patchwork of wetlands, prairies, glades, savannas, forests and caves—all interconnected by seeps, springs, streams and rivers that coursed through them. The diversity of life in these natural communities was stunning. Most of those ecosystems still exist today in one shape or form, but many of their resident species have been extirpated from Missouri, and some have gone extinct.<sup>1</sup>

We are living in an age of catastrophic loss—not of our homes, loved ones or livelihoods—but of our natural heritage. Species are going extinct at an alarming rate worldwide, forever weakening the fabric of natural communities and ecosystems. These dramatic declines in species are due primarily to the intensive human use—and abuse—of their habitats. Two centuries of vast industrial, agricultural and urban development have caused accelerated and, in many cases, irretrievable losses of species. Every animal or plant that disappears makes it less likely the ecosystem it was connected to will continue to function properly.

In Missouri, elk once lived in our forests, huge herds of bison roamed our tallgrass prairies and gray wolves, red wolves and mountain lions were once the top predators. Passenger pigeons, the most abundant bird ever to exist, used to live here too. During the late nineteenth century, settlers took part in mass slaughters of these birds for their meat and feathers and for pleasure shooting, which ultimately led to their extinction. The colorful Carolina parakeet, which used to thrive in bottomland forests throughout the state, met the same fate. Flocks of Carolina parakeets were viewed as agricultural pests, and farmers killed them in large numbers. In the United States, extensive logging of virgin cypress forests during the late 1800s and early 1900s led to the demise of the ivory-billed woodpecker, which once lived in southeastern Missouri.



*Bison were once native to Missouri. This introduced herd lives at Prairie State Park in Barton County.*

Cornell Lab of Ornithology Allen Brooks



*Passenger pigeons, once common in Missouri and throughout North America, are now extinct.*

# Introduction

Jim Rathert



*Trumpeter swans became extirpated from Missouri and most of the United States in the early 1900s. Now, however, a few individuals from restored flocks in northern states visit Missouri in winter.*

Wherever humans have traveled, they have either accidentally or deliberately carried other species with them. The growing world market has created new pathways by which plants and animals are shuttled rapidly from one continent to another, for example, inside a packing crate of vegetables or in the ballast tanks of a ship. Within the borders of most countries, hundreds to thousands of non-native—also called exotic—species have become established. They interfere with native species by altering their habitats, competing with them for limited resources or by directly preying upon them. In many cases, the exotics win out and native diversity—along with all its potential for new discovery and scientific advancement that could benefit humans—is diminished.

Our relatively short history has proven that humans' power to alter the earth is awesome. The same should hold true for our ability to repair or reverse those alterations. However, for many of Missouri's imperiled species, the window of opportunity for recovery is quickly closing. It may seem as if their lives are of no consequence to us, but the interconnectedness of all life is like a house of cards. Imagine that each card represents an individual species on this planet. If just one card is pulled, a portion of the house comes tumbling down, and we are left teetering somewhere on the edge.

This booklet is designed to convey a sense of urgency to readers and what needs to be done to recover and conserve Missouri's imperiled biological heritage. Information about "how we can help" improve conditions for each species is included. It has been proven time and time again that knowledge is power. We must realize that our ability to save species and ecosystems is as potentially powerful as our ability to destroy them.

—Amy Salveter,  
Endangered Species Coordinator,  
Missouri Department of Conservation  
(now Fish and Wildlife Biologist, U.S. Fish and Wildlife Service)

<sup>1</sup> Extirpation means no longer living in a certain location or place. Extinction means no longer living anywhere—"extinction is forever."

# How To Use This Book

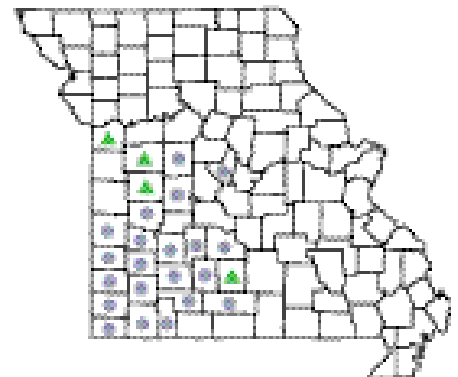
The animal species featured here include a subset of federally endangered species that live in Missouri, as well as several state imperiled species. They represent the broad spectrum of animal species in Missouri that faces a complexity of threats. The Missouri Department of Conservation's Natural History Division collects information on our rare and threatened animals—our animals of conservation concern—so that we can protect them and maintain their populations within our borders. This information is stored in the Missouri Natural Heritage Database. Each species is assigned a rank based on its relative imperilment in Missouri and the world, using a system devised by The Nature Conservancy to evaluate the rangewide condition of species and natural communities. A species' state and global ranks are periodically reevaluated as new information becomes available; these ranks are not included in this booklet. Federal statuses, as of this publication date, are noted in the species' text under the "causes for concern" section.

The *Missouri Species of Conservation Concern Checklist* is updated annually to reflect the current ranks of these species. The *Checklist* also provides an explanation of state and global ranks of these species. If you would like a free copy, please write to: Natural History Division, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102-0180.

Species in this booklet are arranged in order of evolutionary development, in the following categories: mollusks, crustaceans, insects, fish, amphibians, reptiles, birds and mammals. An alphabetical list by species is on page 40.

For each species account, population distributions are illustrated with Missouri and United States maps. The state map identifies counties of occurrence, including extant and historic records; for birds, extant nesting records are shown unless otherwise noted. The United States map combines both the historic and currently known ranges. For birds, the United States map shows summer, winter and year-round ranges.

## Map Example



- Extant location (seen within the last 25 years)
- ▲ Historic location (not seen within the last 25 years)



- Historic and current U.S. range

## Bird Map Example



- Breeding range
- Year-round range
- Wintering range

*State and U.S. ranges were developed using several sources of information, including research reports, Mo. Natural Heritage Database, field guides and books of historical accounts of species.*



# Mollusks

Jim Rathert



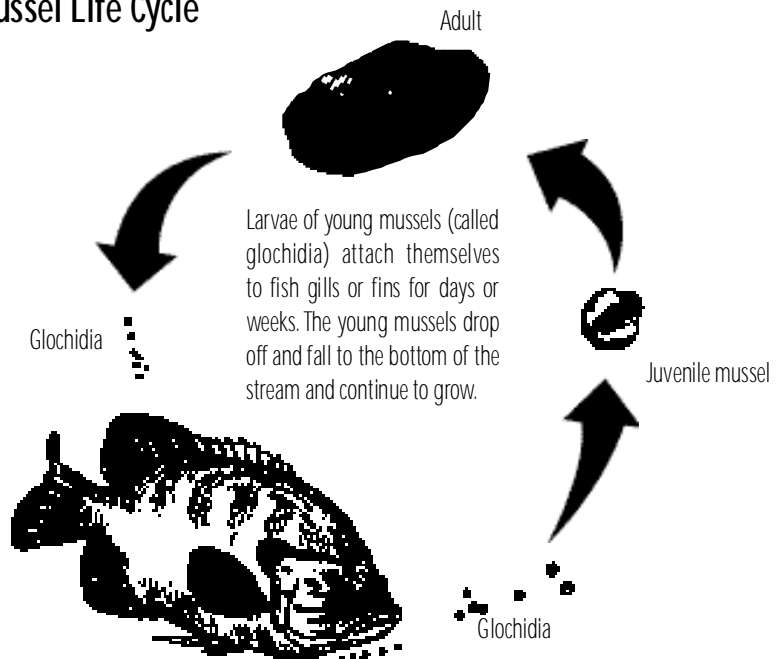
*These mussel species all live in one Missouri stream.*

## Freshwater mussels

Missouri is home to approximately 65 freshwater mussel species; nearly 300 species live in North America. These animals are some of Missouri's most imperiled organisms: Nearly 44 percent of Missouri's species are of conservation concern, and their continued survival is uncertain. Specimens of two freshwater mussel species have not been found in Missouri for years and one of these species may be extinct.

Freshwater mussels have similar life history behaviors. All freshwater mussels are filter-feeders that spend nearly all of their lives partially buried in the river substrate. They eat plankton, zooplankton and small bits of detritus filtered from the water. For many species, spawning occurs during the fall with the female retaining the fertilized eggs until the following spring or summer. Most freshwater mussels have a brief parasitic life stage on fish. Parasitism occurs when the adult female expels mature larvae onto the host fish. The larvae, called glochidia, attach to the gills or fins of the appropriate host fish and remain attached until they transform into juvenile mussels and drop off.

## Mussel Life Cycle



**Causes for concern:** Freshwater mussels are declining throughout North America. Poor land-use practices have resulted in destruction and alteration of habitat and declining water quality. Gravel dredging and stream channelization have destabilized stream substrates and altered water flow, resulting in poor habitat conditions for freshwater mussels.

The rapidly spreading exotic zebra mussel (*Dreissena polymorpha*) presents a future danger to freshwater mussels. Zebra mussels often attach themselves to the shells of native freshwater mussels. This restricts feeding and reproduction activities of the native mussels and may suffocate them. Zebra mussels have a high reproductive rate and quickly colonize new areas, competing with native species for food. Although present in the Mississippi River since 1991, zebra mussels were not found in Missouri until 1999. In that year, zebra mussels were found in the lower Meramec River and one zebra mussel was found near Sioux City, Iowa, in the Missouri River. Only diligent efforts will keep the zebra mussel from spreading throughout the state.

**How we can help:** Landowners can help freshwater mussels and other aquatic organisms by protecting watersheds. Livestock should be excluded from rivers and streams, and waste water treatment facilities and septic systems should be installed. In-stream activities that disturb the stream substrate should be avoided or minimized. Maintaining a 100-foot vegetated corridor along stream and river edges will help minimize soil erosion and the runoff of agricultural chemicals into the water and help maintain good water quality.

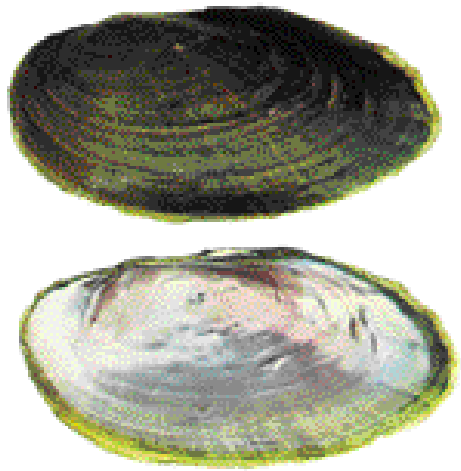
Anglers and boaters can help reduce the risk of spreading zebra mussels by inspecting and removing any observed adults and by removing water weeds from their boats, trailers and other accessories that may harbor the mussels. Drain all bilge water, live wells, bait buckets and any other water from your boat and equipment. Throw away leftover bait and bait water on shore before leaving the area, or return it to the same lake or stream from where it was collected. At home, flush drive units, live wells, hulls and anything that got wet with a hard spray from a hose. Hot water, if available, is best. Let everything dry before your next trip—drying will kill zebra mussels that might be attached. Please contact the Conservation Department for more information on reducing the risk of spreading zebra mussels.



*Zebra mussels can attach themselves to objects such as rocks, as in this photo, and even native mussels, crayfish and aquatic plants.*

# Mollusks

M.C. Barnhart

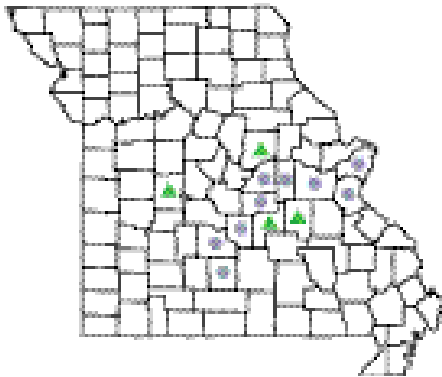


## Scaleshell

*Leptodea leptodon*

The 1- to 3-inch-long scaleshell is very thin and fragile. The interior of its shell, or nacre, is a beautiful purple color. Scaleshells live in a variety of river habitats, usually in riffle areas with substrates consisting of mixed gravel, cobble, boulder and sometimes mud or sand. They occur only in rivers with a stable channel and good water quality. Freshwater drum is the only known suitable host fish for the scaleshell.

The scaleshell is critically imperiled throughout its range. In August 1999, it was proposed for federal listing as endangered. This freshwater mussel species once occurred across much of the eastern U.S. and is now restricted to three midwestern states: Missouri, Arkansas and Oklahoma. Missouri has small but viable populations in two river basins.



Jim Rathert



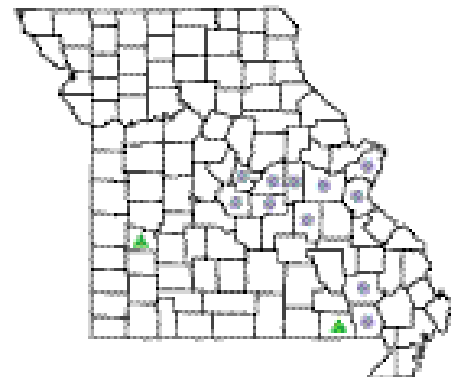
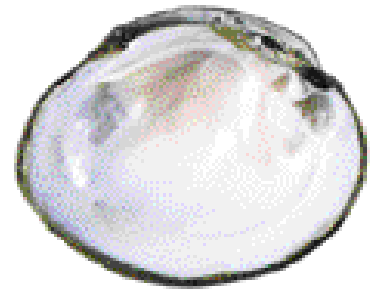


## Pink mucket

*Lampsilis abrupta*

The approximately 4-inch-long pink mucket is a relatively rounded, thick-shelled freshwater mussel. The “pink” refers to the color of the shell interior or nacre. This mussel lives in large rivers in substrate mixtures of sand, gravel and cobble. The pink mucket’s host fishes are largemouth bass, spotted bass, smallmouth bass and walleye.

The pink mucket is listed as endangered by the U.S. Fish and Wildlife Service. Although the pink mucket is wide ranging, it has always been uncommon and rare throughout its range. In Missouri, it primarily occurs in four river drainages; it appears to have been lost from several rivers.



# Mollusks

M.C. Barnhart



## Fat pocketbook

*Potamilus capax*

Resembling a lady's old-fashioned pocketbook, this freshwater mussel is aptly named. The approximately 5-inch-long fat pocketbook shell is very inflated and moderately thick. Historically, fat pocketbooks lived in sand and mud substrates of slow-moving waters of large rivers. Presently, its largest populations occur in dredged ditches of the Missouri Bootheel and northeastern Arkansas. Freshwater drum is the only known suitable host fish for the fat pocketbook.

The fat pocketbook is listed as endangered by the U.S. Fish and Wildlife Service. Although never widespread in Missouri, this species historically was widely distributed in the large navigable rivers of the Midwest. Although unexpected, the drainage ditches of the Missouri Bootheel and especially those in northeastern Arkansas have proven to be a refuge for this species.



## Big Creek crayfish

*Orconectes peruncus*

## St. Francis River crayfish

*Orconectes quadruncus*

These 1- to 2-inch-long crayfish live only in the St. Francis River drainage in Missouri and nowhere else in the world. While their distributions generally complement each other, these two species occur together infrequently. Both crayfishes live in small, clear and fast-flowing rocky creeks, but they sometimes occur in larger streams. Both species excavate cavities in the gravel beneath rocks and rest there during the day. At night they move into the open stream to search for food.

Crayfish play an integral role in the stream life cycle by breaking down dead and decaying plant and animal matter and by serving as food for many other animals. Both Big Creek and St. Francis River crayfish mate in the fall, and the female retains the eggs and sperm until spring. In spring, females release and fertilize the eggs and attach each egg to the underside of her abdomen. Both species can produce more than 100 eggs, which the female will carry for several weeks. After hatching, young crayfish remain attached to the female for several weeks before living on their own. The life spans of both crayfish are thought to be 2 to 3 years.

**Causes for concern:** The existence of both crayfishes is threatened by the woodland crayfish (*Orconectes hylas*). This crayfish, native to the Black River drainage and headwaters of the Big and Meramec rivers, was introduced into the St. Francis River drainage. Thought to be more aggressive in competing for resources, the woodland crayfish appears to be displacing the St. Francis River and the Big Creek crayfishes from certain streams in the drainage.

**How we can help:** Biologists are confident that the woodland crayfish was introduced into the St. Francis River drainage by humans. Anglers and other people who collect animals from streams should never release them into water bodies other than those from which the animals were collected.

Big Creek crayfish

Jim Rathert



St. Francis River crayfish

Jim Rathert



# Crustaceans

Gene Gardner



## Central Missouri cave amphipod

*Allocrangonyx hubrichti*

This tiny white eyeless amphipod lives under rocks or sticks in seven caves and springs in three Missouri counties and nowhere else in the world. It looks like a small shrimp and is often incorrectly called a freshwater shrimp.

Cave amphipods are important members of the food chain and eat bits of dead vegetation that wash into caves and the thin scum covering submerged surfaces. The amphipods, in turn, are eaten by cave-dwelling fish and crayfish. They often live in caves containing bat colonies and feed on bat guano that drops into the water.

**Causes for concern:** This species is considered imperiled in Missouri due to its small population size, its presumed low reproduction potential, the fragility of cave systems and the observed decline and possible extirpation of at least one of its known populations. Cave streams should be kept clean and free of pollutants. Chemical and sewage contamination of groundwater can result in drastic losses of cave animals.

**How we can help:** This species and other karst species (i.e., species that live in springs, caves or underground streams) are highly susceptible to poor water quality. Landowners and others should protect recharge areas that supply water to cave streams and springs. Maintaining trees and other vegetation around riparian areas, cave openings and sinkholes will help reduce siltation and chemical runoff. Chemicals, toxic waste or garbage should not be disposed of in sinkholes or streams. Minimizing human disturbance in caves by closing entrances with bat-friendly cave gates will protect this delicate ecosystem.



## Hine's emerald dragonfly

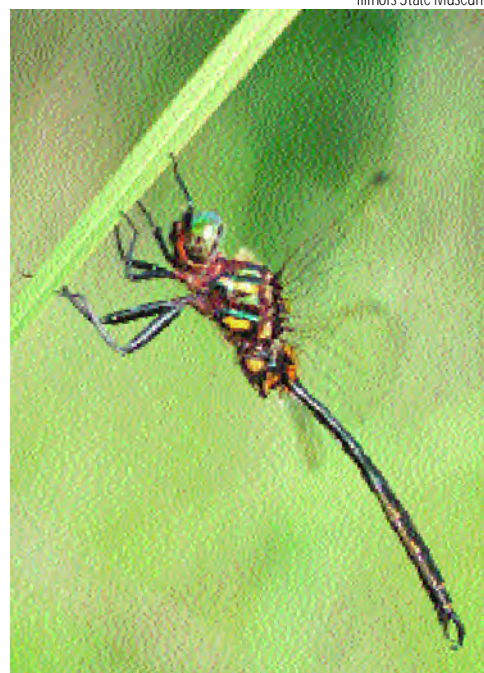
*Somatochlora hineana*

In 1999, this dragonfly was discovered living in Missouri in one of the highest quality fen complexes remaining in the Missouri Ozarks. Its bright green eyes stand out prominently as it flies towards an observer. The Hine's emerald dragonfly has a slender, metallic brown body and clear wings. This dragonfly is approximately 2.5 inches long and has a wingspan up to 3.7 inches wide.

As with all dragonflies, the Hine's emerald dragonfly has an aquatic egg and larval stage and a terrestrial adult stage. Dragonflies live much longer as larvae than they do as adults; the Hine's emerald dragonfly may spend 2 to 4 years as larvae. The larvae are known to feed on smaller aquatic invertebrates, small fish and larval amphibians. Adult emergence begins in late May and continues throughout the summer. Adult Hine's emeralds live 4 to 6 weeks and feed on insects such as gnats and flies captured while flying. Males establish breeding territories that they defend against other dragonflies. Females deposit their eggs in soft muck or in shallow water in a variety of moist habitats including marshes, fens, wet meadows and marshy stream edges.

**Causes for concern:** The Hine's emerald dragonfly is listed as endangered by the U.S. Fish and Wildlife Service. Because it was recently found in Missouri, its status in the state is unknown. Historically, this species lived in Indiana and Ohio; presently it lives in only a few counties in northeastern Illinois and southeastern Wisconsin, the Upper Peninsula of Michigan and in one county in the Missouri Ozarks. The fens and fenlike natural communities where this species lives are very fragile and easily disturbed or destroyed. The only location for this dragonfly in Missouri is on land owned by a private conservation group that protects the site.

**How we can help:** Ozark landowners fortunate enough to have fens on their land can protect them to benefit the many plants and animals that rely on this habitat, perhaps including the Hine's emerald dragonfly.





# Insects

Jim Rathert



## Prairie mole cricket

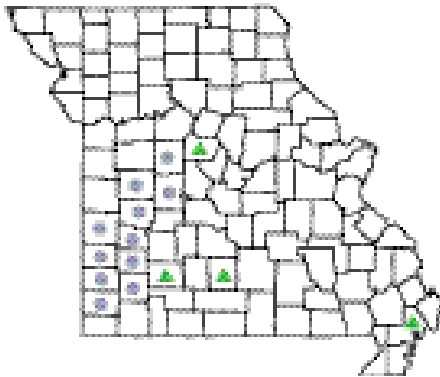
*Gryllotalpa major*

The prairie mole cricket is the largest cricket in North America. It reaches lengths of 2.5 inches and may weigh as much as one-tenth of an ounce. This mole cricket is aptly named after the common mole, a mammal superbly adapted for life underground. Like the mole, the prairie mole cricket has forelegs that are highly modified for digging its underground burrows. In Missouri, this mole cricket lives primarily in the high quality remnants of tallgrass prairie in the western portion of the state.

Prairie mole crickets eat plant roots, invertebrates and other soil organisms. In spring, males move to the surface for courtship and reproduction. At the surface end of the burrow, the male mole cricket constructs a bulblike acoustic chamber that amplifies its mating call. This call can be heard by humans almost a quarter mile away. Female prairie mole crickets respond to the calls and select mates. Eggs are laid in late spring and are guarded by the females until hatching.

**Causes for concern:** The prairie mole cricket is rare in Missouri although its population in the state appears to be stable. At one time, this insect lived throughout the prairies of Missouri, Kansas, Oklahoma, Arkansas, Illinois and Mississippi. It now appears to be gone from Illinois and Mississippi. Agricultural fields and towns have replaced and fragmented the native tallgrass prairie areas where this species lives.

**How we can help:** Landowners in the prairie regions of western and southwestern Missouri can help prairie mole crickets by maintaining or reestablishing tallgrass prairie on their land. Reducing habitat fragmentation and partnering with a neighbor to create larger tracts of prairie will help maintain this and other prairie species. Everyone can help prairie plants and animals by becoming active in organizations that restore and save prairie lands.



## American burying beetle

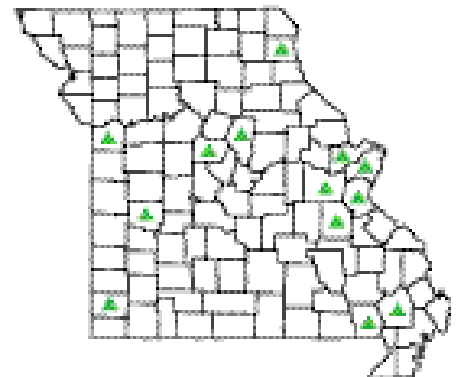
*Nicrophorus americanus*

The American burying beetle is the largest carrion beetle of its kind in North America and is 1 to 1.5 inches long. This beetle is so named because it buries small, dead animals for its larvae to feed upon. The American burying beetle was last seen in Missouri in the mid-1970s where it was captured in a light-trap in Newton County.

Burying beetles are highly social insects that provide parental care to their young. Both parents care for the hatched young for about a week, or until the larvae crawl to a carcass buried by the parents and begin feeding on their own. Later, the larvae move into the surrounding soil to pupate and develop into adults.

**Causes for concern:** The American burying beetle is listed as endangered by the U.S. Fish and Wildlife Service. It now occurs in six states but once ranged throughout the eastern half of the United States. Although this species occurs in many different habitat types, it has recently been found in grassland prairies and open, upland forests. Biologists do not know why this species has declined, although one theory suggests competition for carcasses with other vertebrate scavengers. Other theories suggest that habitat degradation and insecticides caused the decline in American burying beetles.

**How we can help:** Recent discoveries in several Great Plains states have increased the number of known reproducing populations. It is likely that with intensive searching, American burying beetles will be rediscovered in Missouri as well. You can help by watching for this carrion beetle. If you spot a small, halfway-buried dead animal, look to see if American burying beetles are present. If you do observe one, please notify the Missouri Department of Conservation, Natural History Division.



# Insects

Jim Rathert



## Regal fritillary

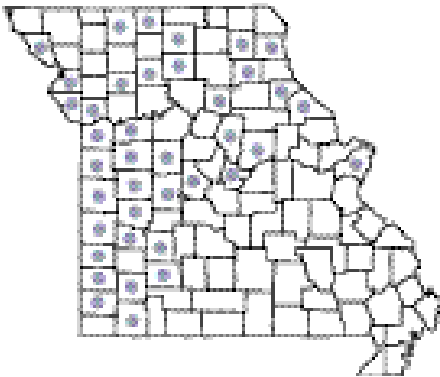
*Speyeria idalia*

Sporting colorful wings and a wingspan of 2.5 to 4.2 inches, the regal fritillary is one of the most eye-catching butterflies of the tallgrass prairie. It lives primarily in the high quality tallgrass prairies of western Missouri. Males and females are easily distinguished from one another by the lowermost row of spots on the upper side of the hindwing: Males have orange spots and females have white spots.

Adult regal fritillaries are active and in flight between June and September. Adults feed on nectar from milkweeds, thistle, clover and other prairie flowers. During midsummer, males, using a low and steady flight, search for females, and mated pairs flutter together across the prairie. Female regal fritillaries walk through the vegetation on the ground searching for violets, the only suitable larval host plant, on which to deposit their eggs. In several weeks the eggs hatch and the larvae seek shelter beneath leaves on the ground and become dormant. In early spring the larvae become active again and begin feeding on violet leaves and eventually pupate. Several weeks later the adult emerges to start the process over again.

**Causes for concern:** Although the regal fritillary is rare in Missouri, its population in the state is stable due to prairie conservation and management. Once ranging across much of the Midwest and Northeast, few viable populations remain outside of the tallgrass prairie of the Midwest.

**How we can help:** Landowners in the prairie region of the state can help regal fritillaries by maintaining or reestablishing tallgrass prairie on their land. Reducing habitat fragmentation and partnering with a neighbor to create larger tracts of prairie will help maintain this and other prairie species. Everyone can help prairie plants and animals by becoming active in organizations that actively restore and save prairies.



## Missouri glyphopsyche caddisfly

*Glyphopsyche missouri*

The Missouri glyphopsyche caddisfly is known from only one spring in the Missouri Ozarks, making it a Missouri endemic species. There are more than 1,350 caddisfly species in North America north of the Rio Grande River.

As with many other aquatic insects, caddisflies spend much of their life in the larval stage. Caddisfly larvae are aquatic and are best known from the cases, or retreats, that they build for protection. The case of the Missouri glyphopsyche caddisfly looks like a small tube constructed with sand and small bits of twigs and bark. Larvae eat algae and other plant matter and pupate and develop into adults within the case. Upon completion of metamorphosis, the caddisfly, still enclosed in a pupal skin, swims to the surface, where the adult hatches from the skin. Adult caddisflies live for several weeks after emergence and feed on plant liquids.

**Causes for concern:** This caddisfly was always rare in Missouri and has a stable population. The Missouri glyphopsyche caddisfly is a site endemic species, which makes the one population we have vulnerable. A mishap, such as a chemical spill or some other major disturbance, could wipe out the entire species. Fortunately, the spring is on protected land and seems safe for the time being.

**How we can help:** Landowners can protect this and other spring-dwelling animals by preventing soil erosion and runoff of chemicals or waste water into streams. Refraining from manipulating or modifying springs and streams will also help conserve caddisfly habitat.





## Pallid sturgeon

*Scaphirhynchus albus*

The pallid sturgeon is a large, ancient fish that lives in the Missouri River and the middle and lower portions of the Mississippi River. Although some may grow 6 feet long and weigh 65 pounds, most are smaller and weigh close to 10 pounds. Pallid sturgeons live in the open channels of large, muddy, free-flowing sections of the big rivers.

Pallid sturgeons are one of the longest-lived fish in Missouri and may live to 50 years. Males reach sexual maturity at 5 to 7 years of age while females may

spawn for the first time at 15 years of age. Biologists believe that pallid sturgeons spawn during late spring in open channels of large rivers and in strong currents over rocky or gravelly substrates. All sturgeons forage on the bottom of the river. Young sturgeon eat aquatic invertebrates and other fish. Adults eat a greater percentage of fish.



**Causes for concern:** Pallid sturgeons are listed as endangered by the U.S. Fish and Wildlife Service. Primary reasons for this species' decline include dam construction, channelization and river navigation maintenance activities of the major rivers. Dams create a barrier to successful sturgeon movement and reproduction, change the flow, temperature and turbidity of the water and destroy suitable in-stream habitat. Channelization has destroyed suitable habitat and increased flow rates. Pallid sturgeons also hybridize with shovelnose sturgeons. This is thought to be due to changes in the big river environment, which have thrown these two species together during the spawning period.

**How we can help:** The U.S. Army Corps of Engineers is responsible for managing the big rivers. Maintaining open and deep channels for barge traffic has resulted in flow and habitat alterations that are not consistent with maintaining good sturgeon habitat. State and federal stocking programs help maintain populations. Ongoing Missouri River management discussions may lead to improved river habitat for river species, including sturgeon.



## Ozark cavefish

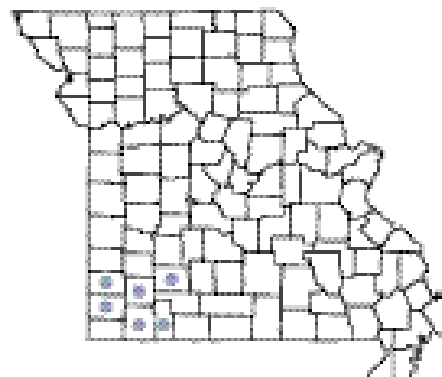
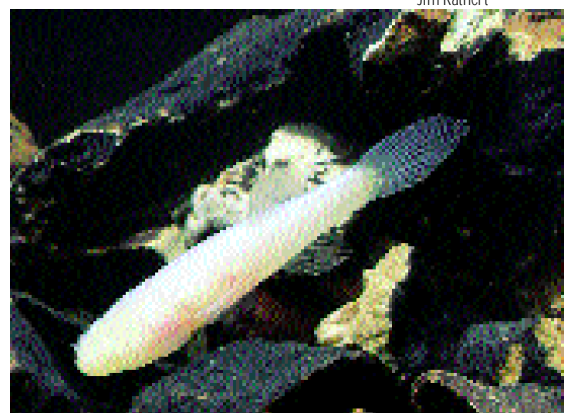
*Amblyopsis rosae*

The Ozark cavefish is one of three cavefishes that lives in Missouri. This small pigmentless fish is less than 2.3 inches long and is blind. It is restricted to springs, cave streams and underground waters of the southwestern portion of the state, in a region known as the Springfield Plateau of the Ozark Highlands. Many Ozark cavefish caves also harbor maternity colonies of the endangered gray bat. It is believed that bat guano provides a food source for the invertebrates on which the cavefish feed.

Biologists believe that the breeding habits of the Ozark cavefish are similar to that of the northern cavefish. Spring floods probably trigger spawning. Fertilized eggs are brooded or held in the female's gill chambers until they hatch. Larval fish remain in the gill chamber for four or five months until the egg sac containing nutrients is absorbed by the young fish. Cavefish use sense organs on the sides of their head, body and fins to find food and carry on life functions in complete darkness.

**Causes for concern:** The Ozark cavefish is listed as threatened by the U.S. Fish and Wildlife Service. Its population in Missouri appears stable with most cave populations still present. Water pollution, habitat destruction, human disturbance and collection may put the Ozark cavefish in jeopardy.

**How we can help:** This species and other karst species (i.e., species that live in springs, caves or underground streams) are highly susceptible to poor water quality. Landowners and others should protect recharge areas of cave streams and springs. Maintaining vegetation and trees around riparian areas, cave openings and sinkholes will help reduce siltation and chemical runoff. Chemicals, toxic waste or garbage should not be disposed of in sinkholes or streams. Minimizing human disturbance in caves by closing entrances with bat-friendly cave gates will protect this delicate ecosystem.





## Niangua darter

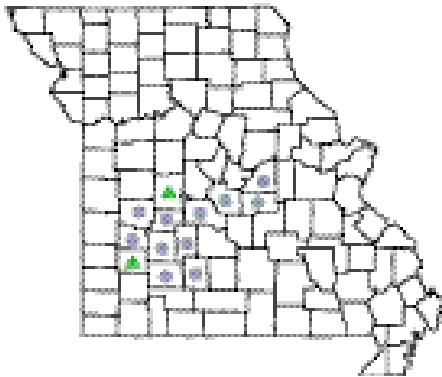
*Etheostoma nianguae*

The 3- to 4-inch-long Niangua darter lives only in Missouri and nowhere else in the world. This darter is named after the Niangua River, which contains the largest remaining population of the Niangua darter. This small, slender and colorful fish is restricted to upland creeks and small to medium-sized rivers with silt-free gravelly or rocky bottoms in the Osage River basin of west-central Missouri. This darter occurs most of the year in shallow pools, stream margins and stream runs.

Niangua darters move from the pools and runs to swift gravelly riffles for spawning. Most spawning occurs in April, with the season running between mid-March and early June. Neither parent assists in protecting the eggs or young. This darter eats the nymphs of stoneflies and mayflies, which they take from crevices between rocks. Niangua darters have been reported to live four or more years, but most survive less than two years.

**Causes for concern:** Niangua darters are listed as threatened by the U.S. Fish and Wildlife Service. Historically, these darters were widespread and abundant in the Osage River basin. The population has declined due to habitat loss from reservoir construction and stream channelization. Sand and gravel removal, stream corridor alteration and water pollution have all contributed to reducing suitable habitat conditions.

**How we can help:** Landowners in the Osage River basin can help this fish and other aquatic animals by establishing and maintaining a natural vegetation strip at least 100 feet wide on either side of the stream. This will provide a healthy stream corridor and improve stream water quality. Cattle should be kept out of the streams to help reduce soil erosion.



## Neosho madtom

*Noturus placidus*

The 3-inch-long Neosho madtom is the smallest catfish in Missouri. It is restricted to the medium-sized, moderate gradient rivers with gravel and cobble substrates of the Spring River basin in southwestern Missouri.

Neosho madtoms are most active at night, foraging on larval caddisflies, mayflies and other insects, primarily within three hours after sunset. As with most madtoms, Neosho madtoms live on the bottom of the stream, in riffles with loose gravel and cobble that provide crevices in which to hide. Neosho madtoms have a late spring to early summer spawning season, with young-of-the-year often observed in July. Eggs are laid in hidden cavity nests and are guarded by one or both parents. Neosho madtoms live two to three years.

**Causes for concern:** The Neosho madtom is listed as threatened by the U.S. Fish and Wildlife Service. This species has a very small range of only 250 to 300 stream miles in the Arkansas River basin in parts of Missouri, Kansas and Oklahoma. Neosho madtoms were never widespread in Missouri and occur in less than 10 stream miles in the state. This species is susceptible to stream habitat loss and water quality degradation through land use changes and practices that alter or destroy stream corridors. Reservoir construction in Kansas and Oklahoma resulted in altered stream flow and reduced and destroyed suitable riffle habitat.

**How we can help:** Landowners in the Spring River basin can help this fish and other aquatic animals by establishing and maintaining a natural vegetation strip at least 100 feet wide on either side of the stream. This will provide a healthy stream corridor and improve stream water quality. Cattle should be kept out of the streams to help reduce soil erosion.





## Topeka shiner

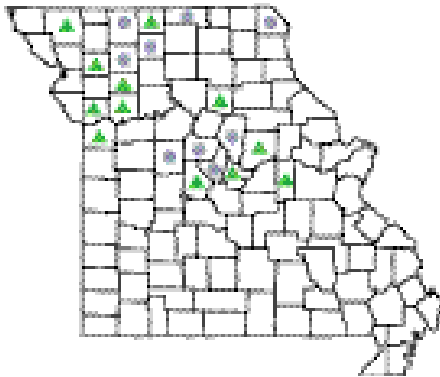
*Notropis topeka*

This small, silvery minnow was once widespread in north-central and west-central Missouri. Today the Topeka shiner is restricted primarily to central Missouri with a few isolated populations in northern Missouri. This shiner is 1.5 to 2 inches long. It lives in pools of small prairie streams with good water quality and gravel streambeds. During the dry summer months, habitat is sometimes reduced to isolated pools in a dry streambed.

As with many minnows, Topeka shiners may live up to three years. They become sexually mature at the end of their second summer. Topeka shiners spawn from May through August over sunfish nests in silt-free gravel. Male Topeka shiners are slightly larger than females and defend small territories around the edge of the sunfish nest. Topeka shiners eat mostly insects.

**Causes for concern:** The Topeka shiner is listed as endangered by the U.S. Fish and Wildlife Service. Land use changes resulting in loss or alteration of stream habitat and diminished water quality have caused this species' rangewide decline. In Missouri, only about 20 percent of the historic locations still support this species. Surviving populations have become isolated and are increasingly at risk due to excessive inputs of sediments, nutrients and chemicals into the streams where they live.

**How we can help:** Landowners can help this fish and other aquatic animals by establishing and maintaining a natural vegetation strip at least 100 feet wide on either side of the stream. This will provide a healthy stream corridor and improve stream water quality. Farming practices such as terracing and no-till cultivation will help decrease soil erosion and prevent nutrient and chemical runoff into the streams.



## Hellbender

*Cryptobranchus alleganiensis*

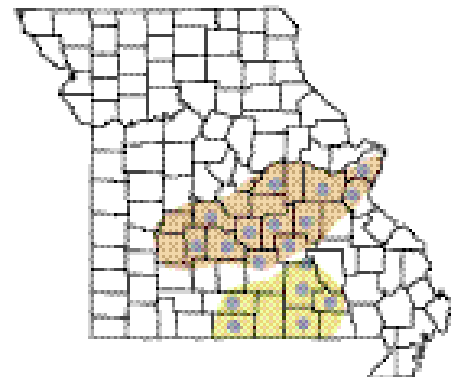
Hellbenders are large salamanders well adapted for life in the water. Adults are 11.5 to 29 inches long. They make their homes under flat rocks in large permanent streams and rivers.

There are two subspecies of hellbenders in Missouri. The eastern hellbender (*C. a. alleganiensis*) lives only in rivers on the Ozark Plateau that drain into the Missouri-Mississippi river system. The Ozark hellbender (*C. a. bishopi*) lives in the Black River system and the North Fork of the White River system.

Hellbenders emerge from under their rocks at night in search of crawfish to eat. They pose no threat to people. They breed from late September to November. Females attract males with pheromones (chemical cues). Their eggs are fertilized externally and look like long strings of pearls. In 4 to 6 weeks the eggs hatch into larvae with yolk sacks attached to their abdomen. The yolks provide larvae with food for up to three months; after that, the larvae begin to seek out food on their own.

**Causes for concern:** Hellbenders have declined significantly over the past decade in Missouri. Recently, biologists have been finding only older adults and no larvae, which suggests that hellbenders are not successfully reproducing. The reason for their decline has not been determined, but poor water quality could be a cause. Most of our rivers and streams have become polluted with sediment, chemicals, and animal and human waste, possibly to levels that hellbenders cannot tolerate. Hellbenders are sometimes collected from the wild and sold illegally as pets.

**How we can help:** There are many things that can be done to improve the water quality of our rivers and streams. Excluding livestock from rivers and streams and installing proper waste water treatment facilities and septic systems are important. Reducing or minimizing the use of fertilizers, herbicides and pesticides will also go a long way towards improving water quality. Report to your local conservation agent any individual who is attempting to collect or sell hellbenders as pets.



- Eastern hellbender range
- Ozark hellbender range





# Amphibians

Tom R. Johnson



## Northern leopard frog

*Rana pipiens*

Northern leopard frogs were named for the large, round, black leopard-like spots covering their bodies. The distinct white rings around each dark spot distinguish them from other species of leopard frogs in Missouri. From snout to hind end they are 2 to 4.4 inches long.

Northern leopard frogs breed in March or April. Males attract females to areas of shallow, open water at dusk using their deep rattling calls that sound like snoring with occasional chuckling grunts. Each female lays as many as 6,000 eggs, which are fertilized externally by the males. In 10 to 15 days, the eggs hatch into tadpoles, which take about two and a half months to transform into froglets.

Northern leopard frogs are sometimes called meadow frogs because they move into grassy areas in the summer where they feed on insects and spiders. In the fall they move to permanent water where they retreat to the bottom and remain all winter.

**Causes for concern:** Most of the natural habitat of northern leopard frogs—open, shallow-water marshes—has been drained and converted to agricultural fields. The small population remaining in northwestern Missouri has survived by making use of flooded ditches and small natural marshes for breeding and wintering.

**How we can help:** Landowners can help northern leopard frogs by protecting any remaining natural small marshes. Breeding habitat can be created by building small pools and shallow marshes. Pesticides should be applied sparingly around wetland or grassy areas where northern leopard frogs live because they can kill eggs, tadpoles and their insect prey.



## Illinois chorus frog

*Pseudacris streckeri illinoensis*

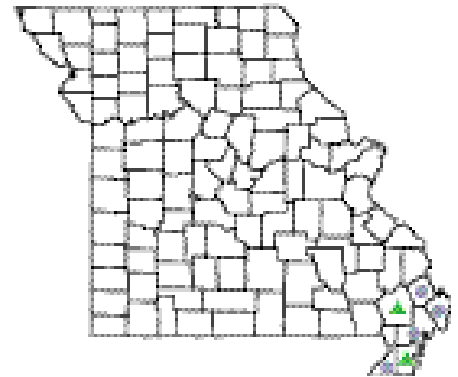
The Illinois chorus frog has a chubby appearance that can be attributed to its large, muscular forelimbs used to dig head first into the soil. From snout to hind end, adults are 1 to 1.8 inches long.

Illinois chorus frogs eat small insects. They breed in late winter or early spring. The males produce a quick series of high-pitched, birdlike whistles to attract females to temporary pools of water where they mate. Each female lays 200 to 400 eggs, which are fertilized externally by the males. The eggs hatch into tadpoles, which take up to 60 days to transform into froglets.

**Causes for concern:** In the past, Illinois chorus frogs lived in the sand prairies of southeastern Missouri. Unfortunately, almost all of the sand prairie habitat has been plowed to grow agricultural crops or covered with housing developments. Today, this species ekes out a living in flat, sandy areas between rows of cotton and soybeans.

Ephemeral pools, the natural wetland breeding habitat of the Illinois chorus frog, have been either destroyed or severely altered. Even though these frogs can still be found in heavily cultivated areas, they may not be able to withstand the widespread use of agricultural herbicides and pesticides.

**How we can help:** Landowners can help Illinois chorus frogs by protecting or creating the shallow, fishless pools they need for breeding. Setting aside areas of sand prairie habitat would help create more places for adult Illinois chorus frogs to live.



# Reptiles

Mark Sullivan



## Eastern massasauga

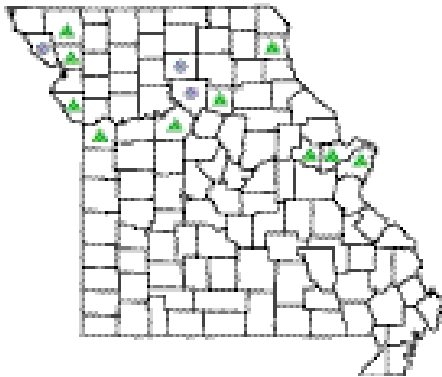
*Sistrurus catenatus catenatus*

Massasaugas are rattlesnakes that live in natural marsh and moist prairie habitats in northern Missouri. Adults are 18 to 34.7 inches long. They use heat-sensitive pits located on both sides of their head to detect warm-blooded prey.

Adult massasaugas mainly eat mice and voles that they kill with a venomous bite. Young massasaugas eat brown snakes, young garter snakes and frogs. Massasaugas are active from April through October and hibernate underground during winter. Adults breed in the spring or autumn. Females produce a litter of 4 to 10 young every other year. The young are born during August or early September and are 8 to 10 inches long with a single rattle segment on their yellow-tipped tail.

**Causes for concern:** The marshes and moist prairies where eastern massasaugas live have been extensively drained and plowed for row crops. Their habitat has been reduced to a few isolated areas in north central and northwestern Missouri. Only three small populations of massasauga rattlesnakes remain in the state. Massasaugas are sometimes intentionally hit on the roads where they often bask, or are collected by people for the illegal pet trade.

**How we can help:** The greatest conservation challenge is convincing people to tolerate and coexist with rattlesnakes. The key to helping this species survive will be cooperation from landowners willing to set aside or restore wet prairie and marsh habitats. Report to your local conservation agent any individual who is attempting to collect or sell massasaugas as pets.



## Western fox snake

*Elaphe vulpina vulpina*

This harmless snake can reach lengths up to 54 inches. In Missouri, western fox snakes live in natural wet prairies or marshes and sometimes in lowland forests or edge habitats between wood lots and pastures. The name fox snake was given to this species because it gives off a musky odor similar to that of a red fox when it is disturbed.

Fox snakes eat mice, chipmunks, small birds and bird eggs that they kill by strangling—or constricting—they with their coils. Young fox snakes eat mostly frogs and insects. Males court and mate with females in April. In June, the female finds leaf litter or a rotten stump or log and lays 8 to 27 eggs that literally stick together. The eggs hatch in August or September.

**Causes for concern:** The western fox snake likely used to live throughout the northern third of the state. Because natural marshes and wet prairie habitats have been extensively destroyed and converted to cropland, there are very few places left where this species can live.

**How we can help:** Western fox snakes can be helped by those who employ a “live and let live” philosophy. Landowners interested in conserving or restoring wetland habitats adjacent to wooded areas on their property can help create more places for this natural rodent controller and other wildlife to live.



# Reptiles

Tom R. Johnson



## Western chicken turtle

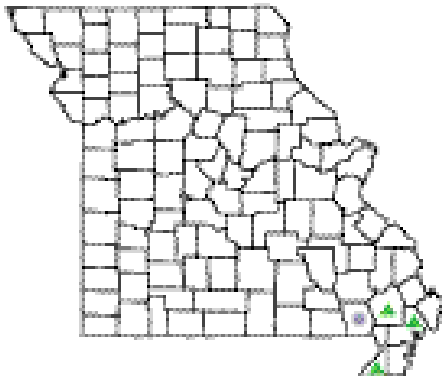
*Deirochelys reticularia miaria*

This long-necked semi-aquatic turtle spends nearly as much time wandering on land as it does in the water. Its oval-shaped shell is 4 to 8 inches long. Western chicken turtles used to live in some of the vast swamps, river sloughs and oxbow lakes that once covered southeastern Missouri.

Western chicken turtles eat a variety of aquatic insects, spiders and crayfish. They are active from March through October, but move into forests where they burrow into the soil and spend the winter. Not much is known about the courtship and mating of western chicken turtles, but it is assumed that they breed during spring and early summer. The females lay and bury their pure white eggs in loose soil on dry land. The eggs probably hatch in late summer or early fall.

**Causes for concern:** Most of the natural wetland habitat in southeastern Missouri has been ditched and drained for agricultural purposes. Western chicken turtles need relatively clear, sediment-free water that supports an abundance of aquatic plants and insects to eat. Today there is only one wetland left in the state where the western chicken turtle lives.

**How we can help:** It is possible to recreate “perched” or elevated shallow wetlands that western chicken turtles need. If you build them in southeastern Missouri, the chicken turtles may come.





## Bald eagle

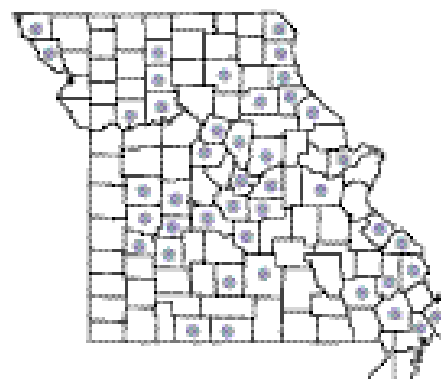
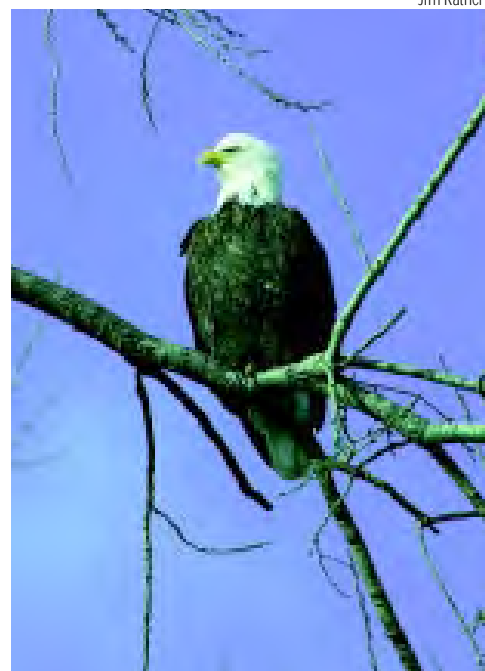
*Haliaeetus leucocephalus*

It takes about five years for adult bald eagles to get their distinguished white or “bald” heads. Immature birds are dark brown overall with blotchy white underwings and tails. Prior to 1900, bald eagles nested throughout much of the state and were particularly abundant in southeastern Missouri swamps. By 1962 they no longer nested in Missouri. The Department of Conservation began reintroducing bald eagles to Missouri in 1981. By 1985 eagles again were nesting in the state, and the number of nesting pairs has been increasing every year.

Bald eagles eat mostly fish but also will eat other birds and mammals. They often scavenge carrion, including dead fish, and will steal food from ospreys and other smaller birds. They normally breed when they are 4 to 5 years old and mate for life. Both the male and female build a nest of sticks and line it with finer materials in the branches of a very tall tree or, in rare cases, on a cliff. One to three young are raised each year by both parents, depending on the availability of prey.

**Causes for concern:** During the mid-20th century, the bald eagle declined drastically as a result of shooting and harmful pesticides such as DDT that entered the food chain and severely diminished the bird’s ability to reproduce. Their numbers dwindled to only 417 pairs in the lower 48 states before steps were taken to prevent extinction. The banning of DDT in 1972 was a critical step toward saving bald eagles and other species. Bald eagles have made a comeback in many areas since the late 1970s and have recovered sufficiently to be removed from the federal list of endangered and threatened species.

**How we can help:** It will always be illegal to harm or harass bald eagles and their nests, eggs and young under the federal Bald Eagle Protection Act. Direct protection of bald eagles and responsible use of pesticides will ensure the continued existence of our majestic national symbol.



*Historically, bald eagles nested along the large rivers in Missouri and in the Bootheel swamps.*



Jim Rathert



## Peregrine falcon

*Falco peregrinus*

The peregrine falcon is the world's fastest bird, reaching speeds up to 200 miles per hour when power-diving from great heights in pursuit of prey. In Missouri, small numbers of peregrines historically nested on bluffs along the Mississippi, Missouri and Gasconade rivers. The last known breeding attempt by peregrines in Missouri was documented in 1911.

Recent reintroductions in St. Louis, Kansas City and Springfield have resulted in small urban-dwelling populations of peregrines in Missouri. Tall buildings serve as effective substitutes for cliff nesting sites. The offspring of these urban peregrine falcons may disperse to their former nesting sites along Missouri's big rivers.

Peregrines typically live in a wide variety of open habitats, usually near water. They eat many kinds of birds, from geese and ducks to small songbirds. In urban areas, peregrines prey upon pigeons, starlings and house sparrows. They occasionally will eat small mammals, insects and rarely carrion. Their nest is a simple scrape where 2 to 6 eggs are laid on a tall cliff ledge, bridge or building. Peregrines that nest at Missouri's latitude are permanent residents, but northern breeders may travel as far as South America to winter.

**Causes for concern:** The negative effects of DDT and other persistent pesticides caused peregrine falcons to become endangered by the mid-20th century. They were also shot by people in the early 1900s. Fortunately, the banning of DDT in the U.S. in 1972 along with aggressive reintroduction efforts resulted in their recovery. In 1999, the peregrine falcon was removed from the federal list of threatened and endangered species.

**How we can help:** Peregrine falcons will continue to be protected under the federal Migratory Bird Treaty Act. Unfortunately, migratory peregrines and their prey could still be exposed to DDT and other harmful pesticides used in South America. (DDT is still manufactured in the United States and sold to other countries.) Joining special interest groups that help raptors and lobbying against the production of DDT in the U.S. can help.



*Historically, peregrine falcons nested in cliffs along the large rivers in Missouri.*



*This U.S. range map depicts wild populations and excludes introduced urban peregrines.*

## Interior least tern

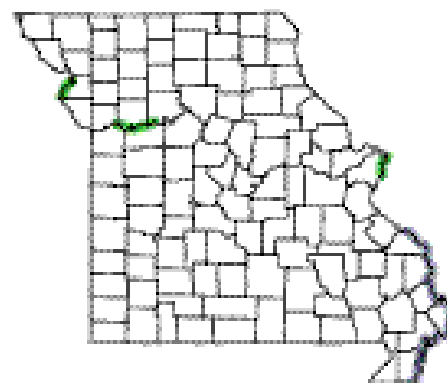
*Sterna antillarum athalassos*

The least tern is named as such because it is the smallest species of tern. It is the only species of tern that presently nests in Missouri. Populations are endangered in many areas because of human impact on the sand islands where they nest. Least terns formally nested along the Missouri River, but now are restricted to a few sand islands along the lower Mississippi River near the Bootheel.

Least terns eat mostly small fish, crustaceans and insects. They forage by flying over the water, hovering and plunging to catch prey just above or below the water's surface. Their courtship ritual consists of the male flying upward with a fish in his bill, followed by the female; they then glide down together. They nest on the ground in groups called colonies, or sometimes in isolated pairs. They lay 1 to 3 eggs in a shallow scrape, sometimes lined with pebbles, grass or debris. Both sexes incubate the eggs and care for the young. In the winter, least terns leave North America and migrate to tropical waters as far south as Brazil.

**Causes for concern:** Our population of least terns is vulnerable to disturbance by people who recreate on their nesting islands. Nests also are destroyed by predators, especially feral dogs and cats. The construction of dams on our big rivers has raised water levels to the point where most of the natural sand islands are submerged during the nesting season. The population of least terns in the interior of the North American continent is federally endangered.

**How we can help:** The only hope for restoring populations of interior least terns would be to schedule water releases from dams in the spring and fall on the Missouri and Mississippi rivers; this would decrease summer flows and expose more sand island habitat during the nesting season.



*Historically, interior least terns were a summer resident and breeder along sandbars in the Mississippi and Missouri Rivers.*





## American bittern

*Botaurus lentiginosus*

The American bittern lives in extensive freshwater marshes where it hides among dense stands of reeds and cattails. Early in the century, American bitterns nested fairly commonly in marshes throughout the state. American bitterns migrate south to the West Indies and Central America, spending the winter in habitat much like the areas of open shallow water mixed with dense vegetation where they nest.

American bitterns are seldom seen, but their unusual territorial pumping or booming song often can be

heard at dusk or at night for long distances across a marsh. Their preferred food is fish and other aquatic life, which they capture with a quick thrust of the bill. In drier habitats they may eat rodents, especially voles. One male may mate with two or three females. Females construct a platform nest of vegetation lined with fine grasses in shallow water or on dry ground among dense cover. The female incubates 2 to 7 eggs and cares for the young alone when they hatch.

**Causes for concern:** American bitterns have severely declined in numbers throughout their range. Ninety percent of Missouri's native wetlands has been lost to agriculture and development. Only a small fraction of the remaining 10 percent is suitable breeding habitat for American bitterns.

**How we can help:** Restoration of permanent shallow marshes is essential to the survival of this and other wetland species. Land-owners interested in recreating wetland habitats are eligible for financial and technical assistance through state and federal conservation agencies.



*Historically, American bitterns were considered a fairly common summer resident and breeder in marshes throughout Missouri.*



## Swainson's warbler

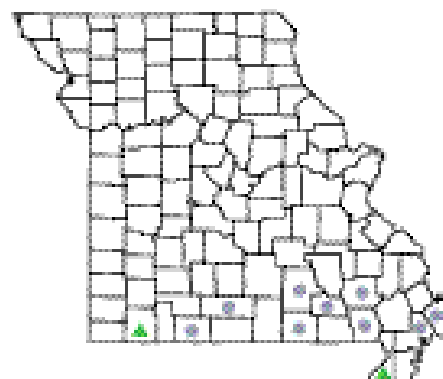
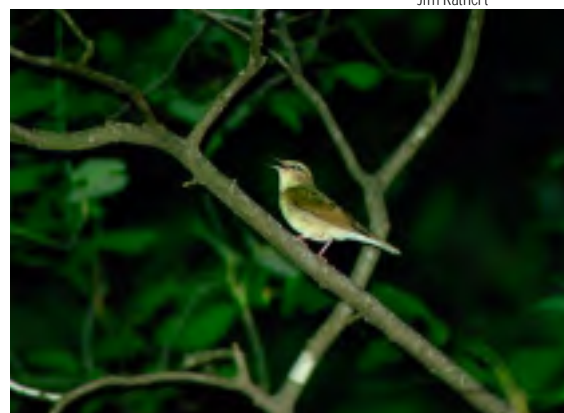
*Limnothlypis swainsonii*

This shy, thick-billed warbler inhabits dense stands of giant cane that grow along big river floodplains and swamps. Swainson's warblers breed in southeastern Missouri and the southern Ozarks; they migrate to Central America, Cuba, Jamaica and the Bahamas to winter.

Swainson's warblers most often are detected by their thin, slurred, whistle-like song. They conceal themselves in dense undergrowth and search for insects on or near the ground. Males typically defend large territories, but if the habitat is good they will nest in loose colonies. Males sing to defend their breeding territories and to attract females. The female builds an open cup nest near or over water out of leaves, sticks and vines, lined with soft material. She will lay and incubate 2 to 5 eggs. Both parents care for the young after they hatch.

**Causes for concern:** The draining and deforestation of Missouri's Bootheel swamps for agriculture and the inundation of bottom-land habitat by reservoirs has impacted Swainson's warblers. The stronghold for the species in Missouri may be along the Current and Eleven Point rivers, which are protected and managed by the National Park Service and U.S. Forest Service. Today, dams control the natural flows of the Mississippi River while levees prevent most bottomland habitat from flooding. These actions have eliminated the process that clears out areas for the cane to spread. Consequently, the vast canebrakes within extensive forests that once lined our largest river are gone.

**How we can help:** There are many organizations dedicated to the conservation of migratory birds that need your support. Land-owners who own land along rivers can help by recognizing the importance of canebrakes and leaving a 100-foot buffer of natural vegetation on both sides of a river.





# Birds

Cornell Lab of Ornithology Bill Dyer



## Cerulean warbler

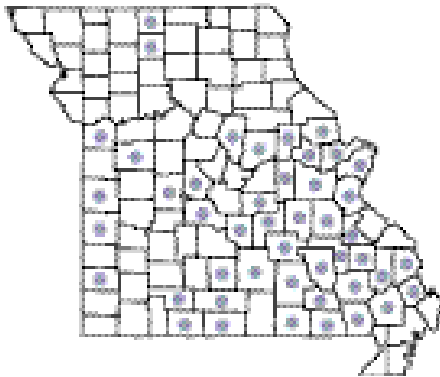
*Dendroica cerulea*

You might need a sky crane to observe cerulean warblers in their lofty, tree-top breeding habitat. Or you can listen carefully for their buzzy song from mid-spring through early summer. They frequently nest in mature hardwood forests in river valleys, where the trees are tall and the understory is relatively open. Cerulean warblers migrate to South America to winter.

The diet of the cerulean warbler is not fully understood, but like most warblers they undoubtedly feed mostly or entirely on insects. Males arrive on their breeding territories near the middle of May. They build their nests near the end of a horizontal tree branch anywhere from 15 to 90 feet above the ground. The small, shallow open cup nest presumably is built by the female out of bark strips, grasses, spider silk and lichen, and lined with moss and fur. She lays and incubates 3 to 5 eggs. After they hatch, the young are fed by both parents.

**Causes for concern:** Surveys indicate that the Cerulean warbler population during the late 1880s was much larger than it is today. In Missouri, their population has declined at an average annual rate of 3.1 percent from 1967 to 1989. Forests that are fragmented by human development and logging not only destroy important cerulean warbler breeding habitat, but also increase the potential for brown-headed cowbird nest parasitism, which is a severe threat to many neotropical migrant birds. Cowbirds lay their eggs in the nests of other birds (parasitize them), who unwittingly raise cowbird chicks to the detriment of their own young. Because cerulean warblers nest in unbroken, mature forests, they are not typically parasitized by cowbirds. Loss of forested habitat on their South American wintering grounds also is contributing to their decline.

**How we can help:** Landowners can help cerulean warblers by setting aside large blocks of mature hardwood forest habitat. Forests should be managed for timber harvest in a way that ensures that mature, relatively open stands are available for these canopy dwellers. Support organizations that work with other countries to conserve the wintering habitats of neotropical migrant birds.



*Historically, cerulean warblers occurred throughout Missouri as a common summer resident and breeder in bottomland, woodland and forests along rivers and streams.*



## Greater prairie-chicken

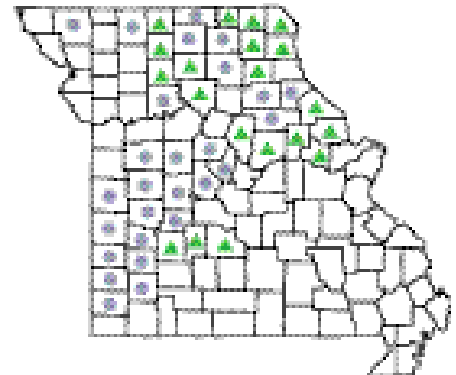
*Tympanuchus cupido*

Fifty years ago, people often heard the eerie, hollow cooing sounds of male prairie-chickens on their spring booming grounds throughout the tallgrass prairies of central and eastern North America. Prime habitat for greater prairie-chickens are places where prairie is intermixed with open oak woodland.

Prairie-chickens eat mostly seeds, leaves and insects. In the spring, males gather on booming grounds (leks) to engage in dramatic displays, all in the name of attracting mates. Their low, hollow booming sounds and loud cackles can be heard up to a mile from the lek site. Females visit the booming grounds, choosing one of the males to mate with, then venture off on their own to raise the young. Their nest is a shallow depression on the ground lined with fine materials and feathers in thick, tall grass. The hen lays and incubates 7 to 17 eggs. The young hatch ready to follow the female away from the nest and find food on their own.

**Causes for concern:** Native prairie once occupied nearly 35 percent of Missouri, but now occupies less than 0.5 percent. Declines in the prairie-chicken population have consequently paralleled or exceeded the decline in prairie acreage since the 1960s, and biologists predict the species will disappear from the state by the year 2009 unless drastic measures are taken to save them. Today, towns and agricultural fields have fragmented and replaced native tallgrass prairie areas, and non-native fescue has replaced nearly all native warm season grasses and forbs. Fire was the natural force that shaped and maintained the tallgrass prairie, but humans have suppressed fires for over a century. In the absence of fire, woody trees and shrubs have increased drastically and invaded areas that once were open grassland. These changes have resulted in more edge habitat that supports an overabundance of potential prairie-chicken nest predators.

**How we can help:** Prairie-chickens can be helped by replanting native prairie plants and using controlled burning to keep non-native fescue and woody vegetation from taking over native grassland habitats. Support organizations dedicated to the conservation and restoration of tallgrass prairie.



# Mammals

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## Gray bat

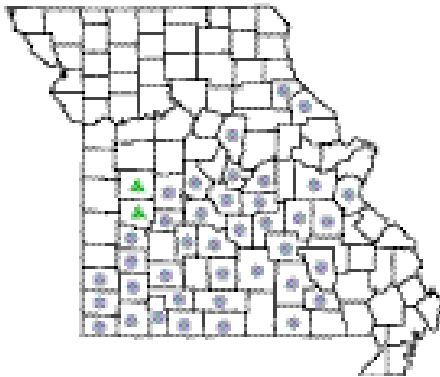
*Myotis grisescens*

This is the only species of bat in Missouri that lives in caves all year. Gray bats use the strong claws on their hind feet to hang upside down from limestone cave ceilings and walls.

Gray bats eat different kinds of insects—like mosquitoes, caddisflies, stoneflies, mayflies and beetles—that vary in availability with the season. They mate in the fall just before entering their winter hibernation caves. They then form large colonies that are several bats deep and may cover as much as 2,000 square feet of the cave wall. The caves that gray bats use for hibernating tend to have a vertical opening or shaft, which creates the lower temperatures necessary for slowing their metabolism and preventing starvation. In the spring, females move to warmer caves with small chambers or high domes where they each give birth to and raise a single young.

**Causes for concern:** Gray bats are listed as endangered by the U.S. Fish and Wildlife Service. Because they live in caves year-round, they are subjected to disturbance by people who explore caves. Females may abort their young, and young bats may drop off the cave wall where they can't be rescued by their mothers. Hibernating gray bats can burn up valuable fat reserves and die of starvation if repeatedly disturbed.

**How we can help:** Disturbance to gray bats can be eliminated by properly installing angle iron gates across important nursery and hibernation cave entrances. Interpretive signs can be placed at the entrances of caves to inform people what time of the year they can enter to avoid unnecessarily disturbing gray bats.



Bill Elliott



*Bat-friendly cave gate*

## Indiana bat

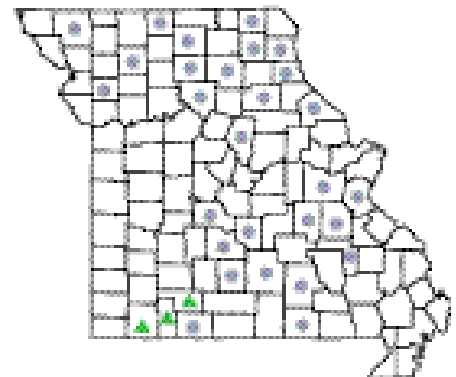
*Myotis sodalis*

This species got its common name because it was first discovered and described in the state of Indiana. Its Latin name *sodalis* means “companion” and refers to this bat’s habit of hibernating in large numbers.

The Indiana bat eats mostly moths, but will occasionally eat other kinds of insects. They mate in early October when they swarm at the entrances of hibernation caves in southern Missouri. There are very few caves that are humid and cold enough to help them slow their metabolism and maintain valuable fat reserves through the winter. Because of this, they come back to the same hibernation caves and a few mines year after year. In the spring, females fly north of their hibernation caves in search of large diameter trees with loose bark where they roost and raise one young. In general, most females raise their young in the northern half of the state. Some males will spend the summer in caves, but most wander about in small groups and roost under the loose bark of trees.

**Causes for concern:** Indiana bats are listed as endangered by the U.S. Fish and Wildlife Service. They have declined significantly over the last 20 years, particularly in Missouri. Biologists have not yet determined why Indiana bats are declining, but speculation ranges from pesticide contamination through their insect prey to changes in the internal temperature of their hibernation caves brought on by several decades of higher average yearly temperatures.

**How we can help:** Disturbance to wintering Indiana bats has been reduced by properly installing angle iron gates across their important hibernation cave entrances. Bats help keep down numbers of potentially damaging insects naturally. Reducing the amount and frequency of pesticides used for home or agricultural purposes would decrease the chances of Indiana bats becoming contaminated through their insect prey. Landowners should refrain from cutting dead or living trees larger than nine inches in diameter that could serve as suitable nursery roost trees for Indiana bats.



# Mammals

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## Plains spotted skunk

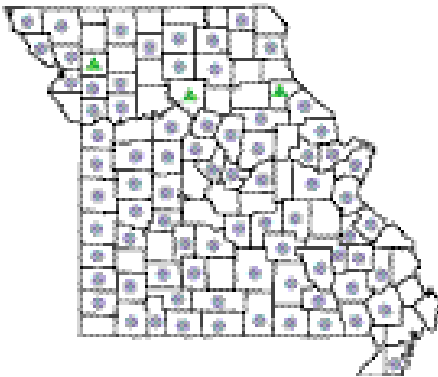
*Spilogale putorius interrupta*

The jet black fur of the plains spotted skunk has distinct white spots and 4 to 6 broken stripes, while the much larger striped skunks have one, two or no stripes. When they need to defend themselves, they stamp their front feet rapidly or try to bluff by doing handstands to make themselves look larger. They spray their pungent, acidic musk only as a last resort for defense.

Spotted skunks live in open tallgrass prairies, forests, brushy areas and cultivated land. During the summer they eat mostly insects such as grasshoppers, crickets, ground beetles and scarab beetles, and also some plants and fruits. Their winter diet consists mostly of mice. Litters of about five baby spotted skunks are born from April to July.

**Causes for concern:** Spotted skunks once were common in the western half of the state but have declined drastically throughout their range. Although one to three observations of single individuals have been made in most Missouri counties as recently as 1991, overall, plains spotted skunks have greatly declined in Missouri. Possible reasons for their decline are numerous. The drought of the mid-1930s was followed by a loss of habitat as small farms were replaced by larger, more mechanized operations. This resulted in improved grain storage and more efficient harvest techniques, which reduced the amount of available waste grain and rodent prey. The removal of hedgerows and destruction of outbuildings eliminated much of the denning and feeding habitat of spotted skunks. The introduction of harmful pesticides like DDT may have affected their populations. Annual fur harvest of spotted skunks in Missouri declined from 55,400 in 1940 to 1 in 1989.

**How we can help:** Spotted skunks need brushy cover, such as field borders, hedge rows or gullies for hiding places. Denning sites can be provided to spotted skunks by retaining farm outbuildings, woodpiles, hollow logs or trees, stone piles, fence rows or brush heaps. Limiting the use of herbicides and pesticides would increase their insect prey. Landowners willing to coexist with spotted skunks receive a chemical-free, cost-free pest control service.





## Black-tailed jackrabbit

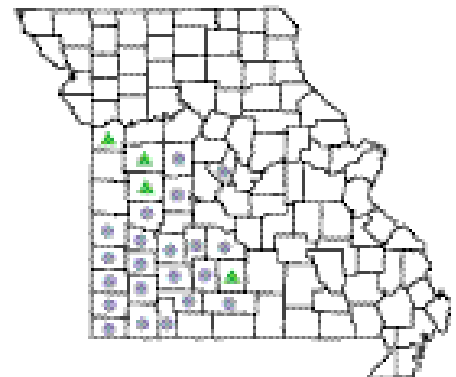
*Lepus californicus*

Black-tailed jackrabbits clear between 5 and 10 feet of ground per jump at an easy, regular pace. They can clear 15 or 20 feet of ground per jump running 30 to 35 miles per hour when they really want to speed. They can leap five and a half vertical feet off the ground if they want a better view of their surroundings. The name “jack” was given to them because of their keen, 4- to 7-inch-long ears that resemble those of a jackass (male donkey).

The black-tailed jackrabbit lives in prairies, pastures and haylands in southwestern and central Missouri. Their home range can be 1 to 2 square miles. They wear trails in the vegetation because they travel the same routes over and over again. Jackrabbits eat only plant parts like leaves, buds, twigs, bark, fruits and roots. They don't need to drink water often because they get plenty of moisture from the vegetation they eat. Jackrabbits can breed any time of year, but they usually breed from late winter to midsummer. Females can have 1 to 4 litters of about 2 to 4 young per year. The young are born with their eyes open and with some fur. They are nursed once every night and become independent of the mother when they are 3 to 4 weeks old.

**Causes for concern:** In the past, black-tailed jackrabbits were killed by the thousands for the meat and fur markets. Today, they can no longer be hunted in Missouri. Black-tails used to be plentiful in the prairie regions of the state, but are becoming increasingly scarce. The best remaining population in Missouri lives around a few dairy farms in the southwestern part of the state.

**How we can help:** It is likely that black-tailed jackrabbits are suffering from the loss of native tallgrass prairies in Missouri. They need large expanses of grassland with open vistas that aren't obstructed by tree lines, roads, crop fields or housing developments. Black-tailed jackrabbits can be helped by restoring large areas of open grassland habitat, replacing non-native fescue with native warm-season grasses and forbs.



# Mammals

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## Swamp rabbit

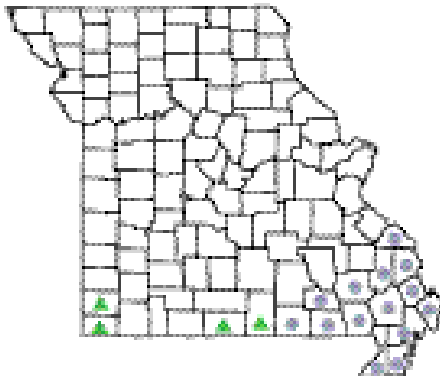
*Sylvilagus aquaticus*

Never far from water, the swamp rabbit was aptly named. Swampers, as they are sometimes called, live in cane thickets along rivers, in brush bordering swamps or in bottomland forests in southeastern and southern Ozark regions of Missouri. They are good swimmers, often evading capture by diving into the water and paddling with all four feet or only their hind feet.

Swamp rabbits are most active at night or at dawn or dusk. They feed on river cane, grasses, sedges, tree seedlings and other soft-stemmed plants. Swamp rabbits have the capacity to reproduce year-round, but litters are generally born February through mid-July when the vegetation is most lush. Their gestation period is 35 to 40 days (slightly longer than the cottontail) and a single female can produce up to 5 litters of 1 to 6 (usually 3 to 4) young per year!

**Causes for concern:** Loss of habitat—not a low reproductive rate—is the reason swamp rabbit populations are decreasing. Their decline is directly related to the dramatic loss of forested and brushy bottomland habitat in the Bootheel over the last 50 years. These habitats have been mostly cut, cleared and converted to agricultural fields. To make matters worse, large-scale changes in lowland habitat and channelization and dredging of the big rivers and their tributary streams have caused floods to be more frequent. Places that still have forested habitat often remain flooded from February through June—optimum breeding months for swamp rabbits. Faced with a loss of habitat and an increase in flooding of the small, isolated forest fragments that remain, swamp rabbits have dwindled to the point where they might disappear from Missouri altogether.

**How we can help:** Landowners in southeastern Missouri can help improve conditions for swamp rabbits by protecting forested corridors along rivers and bottomlands or by replanting those areas in native tree species. Swamp rabbits also need forested areas on higher ground for refuge from flood waters. Building brush piles or retaining dense thickets of vegetation also will make an area more hospitable to swamp rabbits.



## Mountain lion

*Puma concolor*

In addition to mountain lion, the names cougar, puma, panther and catamount have been used to refer to this large cat. Bobcats are common in Missouri, and are often mistaken for mountain lions. Adult mountain lions have solid instead of spotted fur, are taller and heavier, and leave 3- to 4-inch instead of 2-inch tracks. They also have very long tails that measure 21 to 35 inches; bobcats have short “bobbed” 3- to 7-inch tails.

Mountain lions prefer rocky, rugged terrain with plenty of cover. In general, they will avoid areas where people live. The size of their home range depends on how much food is available, but can range from 15 to 35 square miles. Males typically have larger home ranges than females. Males and females are solitary except when they mate. The young can be born during any month of the year, but usually are born in the summer. Females will have 1 to 6 kittens in a litter, but the average is 2 or 3. The kittens are born blind and helpless, and have buff-colored fur with black spots. Kits often stay with their mother until they are two years old.

**Causes for concern:** Mountain lions once lived throughout Missouri before people intentionally eradicated them and virtually wiped out their primary food—white-tailed deer. Until recently, the last confirmed record of a wild mountain lion in the state was of one killed in 1927 in the southeastern lowlands.

**How we can help:** It is possible for people to coexist with wild, free-ranging mountain lions, because they typically feed on deer and avoid areas of human habitation. Many people in Missouri keep mountain lions as pets. Escaped captive-reared mountain lions typically seek out areas where people live because they associate humans with being fed, and could pose a threat. Wild animals are always better off living in the wilderness away from people.



*Historically, mountain lions occurred statewide.*



# List of Animals Included in Booklet

Page	Species		
10	<i>Allocrangonyx hubrichti</i>	35	<i>Myotis sodalis</i>
17	<i>Amblyopsis rosae</i>	19	Neosho madtom
30	American bittern	18	Niangua darter
13	American burying beetle	13	<i>Nicrophorus americanus</i>
27	Bald eagle	22	Northern leopard frog
9	Big Creek crayfish	20	<i>Notropis topeka</i>
37	Black-tailed jackrabbit	19	<i>Noturus placidus</i>
30	<i>Botaurus lentiginosus</i>	9	<i>Orconectes peruncus</i>
10	Central Missouri cave amphipod	9	<i>Orconectes quadruncus</i>
32	Cerulean warbler	17	Ozark cavefish
21	<i>Cryptobranchus alleganiensis</i>	16	Pallid sturgeon
26	<i>Deirochelys reticularia miaria</i>	28	Peregrine falcon
32	<i>Dendroica cerulea</i>	7	Pink mucket
24	Eastern massasauga	36	Plains spotted skunk
25	<i>Elaphe vulpina vulpina</i>	8	<i>Potamilus capax</i>
18	<i>Etheostoma nianguae</i>	23	<i>Pseudacris streckeri illinoensis</i>
28	<i>Falco peregrinus</i>	12	Prairie mole cricket
8	Fat pocketbook	39	<i>Puma concolor</i>
4	Freshwater mussels	22	<i>Rana pipiens</i>
15	<i>Glyphopsyche missouri</i>	14	Regal fritillary
34	Gray bat	9	St. Francis River crayfish
33	Greater prairie-chicken	6	Scaleshell
12	<i>Gryllotalpa major</i>	16	<i>Scaphirhynchus albus</i>
27	<i>Haliaeetus leucocephalus</i>	24	<i>Sistrurus catenatus catenatus</i>
21	Hellbender	11	<i>Somatochlora hineana</i>
11	Hine's emerald dragonfly	14	<i>Speyeria idalia</i>
23	Illinois chorus frog	36	<i>Spilogale putorius interrupta</i>
35	Indiana bat	29	<i>Sterna antillarum athalassos</i>
29	Interior least tern	31	Swainson's warbler
7	<i>Lampsilis abrupta</i>	38	Swamp rabbit
6	<i>Leptodea leptodon</i>	38	<i>Sylvilagus aquaticus</i>
37	<i>Lepus californicus</i>	20	Topeka shiner
31	<i>Limnothlypis swainsonii</i>	33	<i>Tympanuchus cupido</i>
15	Missouri glyphopsyche caddisfly	26	Western chicken turtle
39	Mountain lion	25	Western fox snake
34	<i>Myotis grisescens</i>		

# Known Extirpated Animals From Missouri

## Mollusks

*Quadrula fragosa* .....winged mapleleaf

## Crustaceans

*Stygobromus heteropodus* .....Pickle Springs amphipod

## Insects

*Isoperla longiseta* .....a spring stonefly

## Fish

*Lepisosteus spatula* .....alligator gar

*Notropis amnis* .....pallid shiner

## Reptiles

*Heterodon nasicus gloydi* .....dusty hognose snake

*Heterodon nasicus nasicus* .....plains hognose snake

*Liochlorophis vernalis* .....smooth green snake

*Nerodia cyclopion* .....Mississippi green water snake

*Regina septemvittata* .....queen snake

## Birds

*Anhinga anhinga* .....anhinga\*

*Campephilus principalis* .....ivory-billed woodpecker

*Chlidonias niger* .....black tern\*

*Conuropsis carolinensis* .....Carolina parakeet (extinct)

*Corvus corax* .....common raven

*Cygnus buccinator* .....trumpeter swan\*

*Ectopistes migratorius* .....passenger pigeon (extinct)

*Elanoides forficatus* .....swallow-tailed kite

*Picoides borealis* .....red-cockaded woodpecker

*Sitta pusilla* .....brown-headed nuthatch

*Vermivora bachmanii* .....Bachman's warbler

## Mammals

*Bos bison* .....American bison

*Canis lupus* .....gray wolf

*Canis rufus* .....red wolf

*Cervus elaphus* .....wapiti (elk)

*Corynorhinus townsendii ingens* .....Ozark big-eared bat

*Lepus townsendii* .....white-tailed jackrabbit

\*Extirpated as a breeder only. Non-breeding individuals sometimes observed.

**Extirpated:** no longer living in a certain location or place.

For a complete listing of Missouri's species of conservation concern, write to Missouri Species of Conservation Concern, Missouri Department of Conservation, Natural History, P.O. Box 180, Jefferson City, MO 65201.

For more information on endangered species in Missouri, view [www.conservation.state.mo.us/nathis](http://www.conservation.state.mo.us/nathis).





Missouri Department of Conservation